

Customer No.: 31561  
Docket No.: 12009-US-PA  
Application No.: 10/605,782

REMARKS

Present Status of the Application

The claims 1, 3-6 and 13-16 are rejected under 35 U.S.C. 103(a), as being unpatentable over Maiti et al. (US Patent 5,885,870) in view of Kusumi et al. (US Patent 6,545,312) and further in view of Ohmi et al. (US Patent 6,551,948), and as being unpatentable over Mahajani et al. (US 2005/0062098) in view of Ohmi et al. (US Patent 6,551,948).

Discussion of Office Action Rejections

*The Office Action rejected claims 1, 3-6 and 13-16 under 35 U.S.C. 103(a), as being unpatentable over Maiti et al. (US Patent 5,885,870) in view of Kusumi er al. (US Patent 6,545,312) and further in view of Ohmi et al. (US Patent 6,551,948), and as being unpatentable over Mahajani et al. (US 2005/0062098) in view of Ohmi et al. (US Patent 6.551.948).*

Applicants respectfully assert that Maiti et al. in view of Kusumi er al. and further in view of Ohmi et al. or Mahajani et al. in view of Ohmi et al. is legally deficient for the purpose of rendering claims 1 and 13 unpatentable for at least the reason that not every element of the claim was taught or suggested by cited references such that the invention as a whole would have been obvious to one of ordinary skill in the art.

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The present invention specifically teaches "performing a thermal drive-in process to diffuse the introduced nitrogen atoms across the silicon oxide layer" as taught in claim 1 and 13.

In Maiti et al. ('870; col. 1, lines 45-51), the thermal annealing process has been conducted, but the effect of thermal drive-in is not like that on the nitrided oxide treated with plasma nitridation technique. For Maiti's method in which the nitridation is conducted with thermal N<sub>2</sub>O, NO, or NH<sub>3</sub>, the nitrogen distribution is already quite close to the interface of SiO<sub>2</sub> and Si substrate, especially for the tunnel oxide with thickness scheme more than 30Å. Therefore, there almost exists no "drive-in" effect in this circumstance. As for our method with plasma nitridation technique, the nitrogen atoms will be located almost within 30 Å from top surface of SiO<sub>2</sub>. Therefore, the thermal process is thus required for "drive-in" purpose of nitrogen, but not the purposes disclosed in *Maiti et al.* such as "relieving stress", "densifying", etc. (see col. 2, lines 6-9).

In Ohmi et al., the applications of plasma nitridation technique all belong to the insulating films between floating gate and control gate in flash memory. Based on this purpose, the films are standing on the floating gate which is made by "polysilicon". Due to the difference of the film and surface property between polysilicon and the silicon substrate, the advantage of plasma oxidation/nitridation technique is revealed. However, it doesn't matter to the business of tunnel oxide application because this dielectric always stands on silicon substrate which has better surface quality with single crystal structure. In addition, Applicants experimental results shown that the tunnel oxide performance can not be improved if only conducting plasma nitridation on

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silicon oxide without post thermal drive-in process (please refer to the plots in last action). Therefore, it is not acceptable that the techniques in '870 and '948 can be easily combined together.

Although the tunnel oxide formed by ISSG has been disclosed ('312; col. 27, lines 27-30), this does not matter to the application of plasma nitridation along with post thermal drive-in of nitrogen.

Even though Maiti et al. in view of Kusumi et al. and further in view of Ohmi et al., or Mahajani et al. in view of Ohmi et al., do not contemplate element "performing a thermal drive-in process to diffuse the introduced nitrogen atoms across the silicon oxide layer" in this invention. The examiner fails to establish the evidence for *prima facie* conclusion of obviousness. Applicants therefore respectfully submit that Maiti et al. in view of Kusumi et al. and further in view of Ohmi et al., or Mahajani et al. in view of Ohmi et al. does not render the present invention of claims 1 and 13 unpatentable. Applicants respectfully request that the Office withdraw of the rejection of claims 1 and 13.

Dependent claims 3-6 and 14-16 are submitted to be patentably distinguishable over the prior art of record for at least the same reasons as independent claims 1 and 13 from which these claims respectively depend, as well as for the additional features that these claims recite.

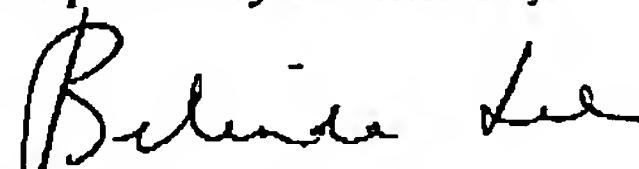
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**CONCLUSION**

For at least the foregoing reasons, it is believed that the pending claims 1, 3-6 and 13-16 are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

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Respectfully submitted,

  
Belinda Lee

Registration No.: 46,863

Jianq Chyun Intellectual Property Office  
7<sup>th</sup> Floor-1, No. 100  
Roosevelt Road, Section 2  
Taipei, 100  
Taiwan  
Tel: 011-886-2-2369-2800  
Fax: 011-886-2-2369-7233  
Email: [belinda@jcipgroup.com.tw](mailto:belinda@jcipgroup.com.tw)  
[Usa@jcipgroup.com.tw](mailto:Usa@jcipgroup.com.tw)